

RHIZANTHELLA R. S. ROGERS,
A MISUNDERSTOOD GENUS (ORCHIDACEAE)

Pamela Balogh*

Rhizanthella gardneri Rogers has been regarded as a botanical oddity spending most of its life underground only to rise to the surface to be pollinated and to disperse its seeds. The genus was established in 1928 by Rogers based on a Western Australian collection of John Trott.

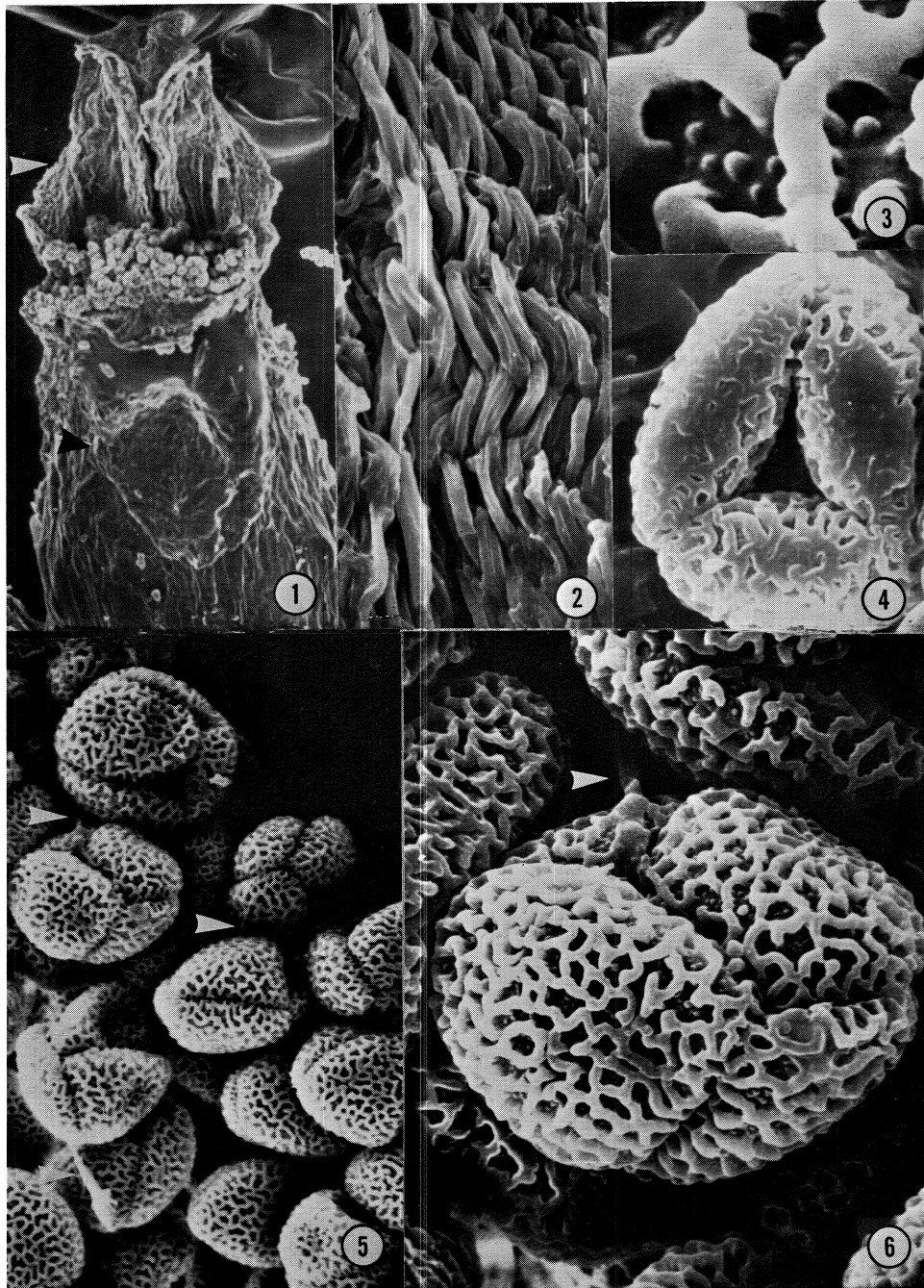
Relying, in part, on the drawings of C. A. Gardner and W. H. Nicholls, Rogers described (1928) the column as "erect, almost equal in length to the sepals, not winged, terete, adnate to petals and dorsal sepal, produced into a short foot at the base; anther persistent, terminal, erect, without a point, obtuse, compressed laterally at the apex, widely attached to the clinandrium, slightly concave; pollinia 4, granular, subsessile on the minute viscidium of the rostellum; stigma prominent, ovate; rostellum erect, emarginate, shorter than the anther." He noted (1928) that *Rhizanthella* was "neottious in character . . . affinities with Gastrodiinae . . . undoubtedly most closely related to *Gastrodia* . . . differs in the remarkable inflorescence . . . in its un-winged column, and in its stigma which is situated on the face of the column near the apex, . . . and likewise by its slenderly clawed labellum." For these reasons, he made *Rhizanthella* the type of the new subtribe Rhizanthellinae and placed it in tribe Polychondreae Schlechter (1926). [This tribe is equal in concept to Neottieae of Dressler and Dodson (1960).]

Possibly due to the poor condition of the flowers, and Rogers remarked that the material he saw was fragmentary or damaged, portions of the column were misinterpreted. *Gastrodia* is also a saprophyte and some species do resemble the flowers of *Rhizanthella*, but the anther of *Gastrodia* is operculate and incumbent such as found in Epidendriodeae, the stigmatic surface is transversally oblong, the pollinarium is sectile, and the column is broadly winged. The column of *Rhizanthella*, on the other hand, resembles that of the Limodorinae, especially *Cephalanthera* L. C. Richard. There is a thickened callus at the apex of the anther, the column is slightly curved and has a large shield-shaped stigmatic surface composed of two lobes with a subcentrally located stylar canal entrance (Figures 11, 12). The column is fused to the base of the sepals and petals. There appear to be only two pollinia each of which is borne in a locule, but there is no apparent viscidium or rostellum.

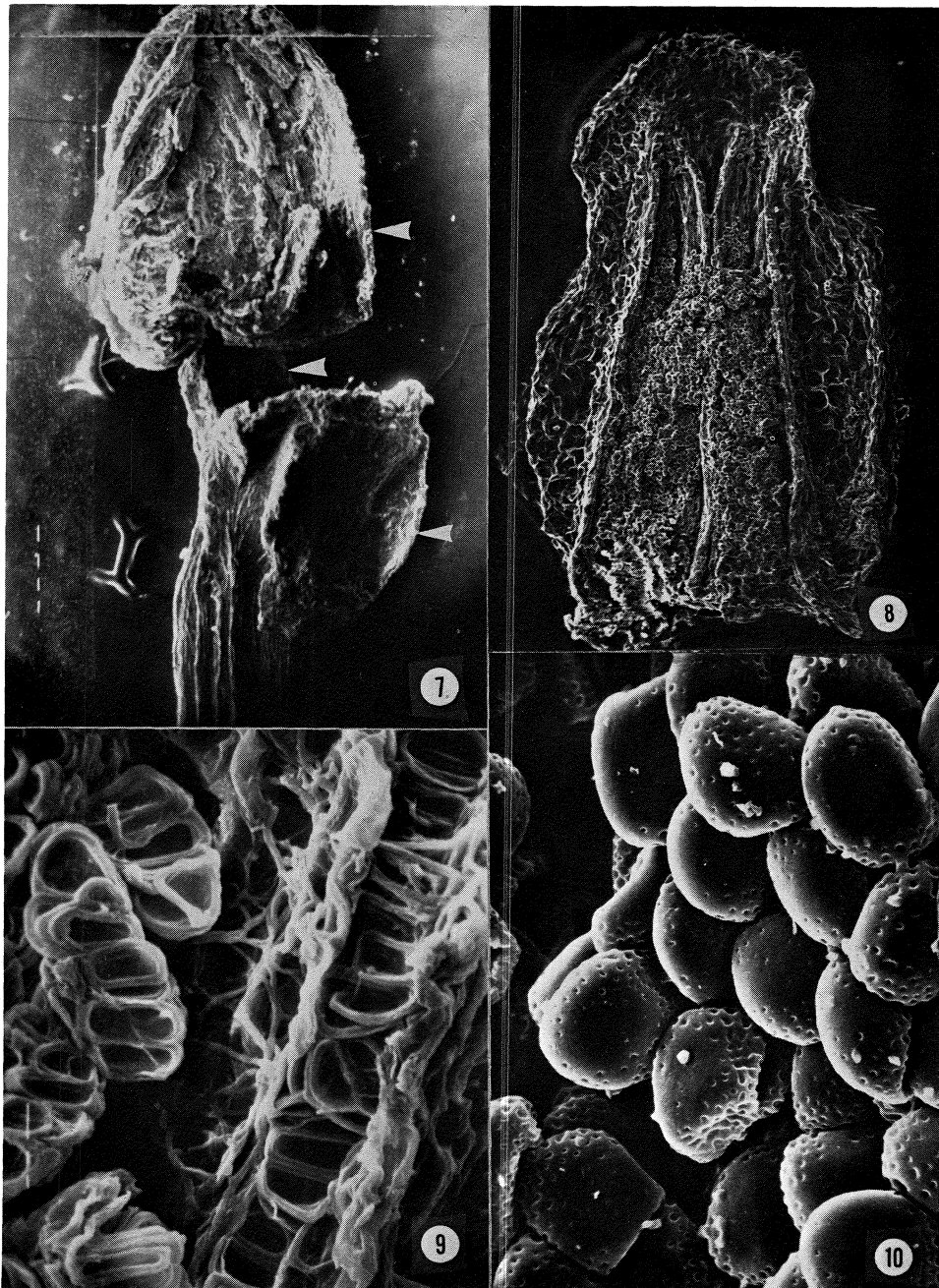
The plants (Figure 13) are brittle and succulent, ensheathed by bract-like leaves, and the flowers are crowded into a dense capitulum (Figure 14) somewhat resembling an aster. Each flower is subtended by a lanceolate bract and the entire inflorescence is subtended by larger bracts which form a cup-like structure around the flowers. The inflorescence grows close to the soil surface and as they mature the large floral bracts push away the soil exposing the flowers to the air. The flowers produce a slightly sweet fragrance (Bernhardt, 1980). The bracts are translucent white and the flowers are white at the base grading to a deep maroon. The sepals and petals are adherent to one another so that the flower has a closed appearance. The labellum is thick and fleshy and has a short claw. It protrudes out of the slit formed by the opening of the sepals and petals, similar to *Cephalanthera pallens* L. C. Richard of subtribe Limodorinae. Plants are subterranean, lack roots and chlorophyll, and the "leaves" are reduced to thin scale-like structures.

After the flowers are fertilized, the fruiting head emerges above the soil line, the capsules open and the seeds are dispersed upon the wind (Bernhardt,

*Montgomery College, Germantown, MD 20767 U.S.A.



Figures 1-6. Morphology of *Rhizanthella gardneri*, from McGuiness. Fig. 1. Column, ventral surface, top arrow pointing to the anther, bottom arrow pointing to the stigmatic surface (bottom lobe dried), $\times 100$. Fig. 2. Endothelial thickenings, side view, $\times 1000$. Fig. 3. Exine showing reticulum with free verrucae on lumen, $\times 10,000$. Fig. 4. Outer tetrad showing polymorphic exine, $\times 5100$. Fig. 5. Tetrads held together by cohesion strands (arrow), $\times 800$. Fig. 6. Tetrad showing a close-up of cohesion strand (arrow) $\times 2175$.



Figures 7-10. Morphology of *Cephalanthera*. Fig. 7. *Cephalanthera pallens*, from Dressler. Column, ventral surface, top arrow pointing to anther, middle arrow pointing to free anther filament, bottom arrow pointing to stigmatic surface, X 25. Fig. 8. *C. austinae*, from Sandberg & Leiberg. Anther showing two locules (folding of locule wall in center of each), X 40. Fig. 9. *C. pallens*, endothelial thickenings, X 600. Fig. 10. *C. austinae*, aggregated monads showing polymorphic exine, X 950.

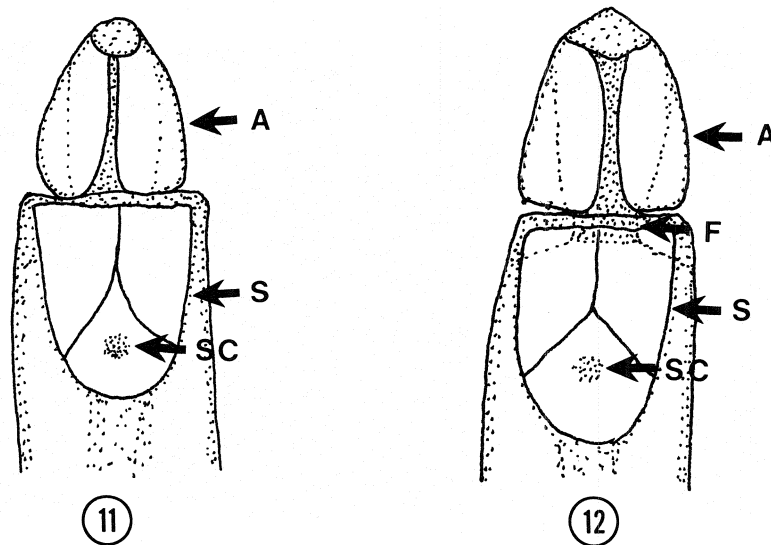


Figure 11. *Rhizanthella gardneri*, column structure, ventral view, A-anther; S-stigmatic surface; SC-stylar canal entrance, $\times 65$. Figure 12. *Cephalanthera*, column structure, ventral view, stigmatic surface drawn transparent to show dorsal anther filament, A-anther; F-filament; S-stigmatic surface; SC-stylar canal entrance, $\times 15$.

1980). *Rhizanthella* lives in a symbiotic association with a mycorrhizal fungus, i.e., *Rhizoctonia*, similar to other terrestrial orchids and is found in association with the mallee tree, *Melaleuca uncinata* R. Br.

In 1960, Dressler and Dodson placed Rhizanthellinae in alliance with Cloraeinae in tribe Neottieae, subfamily Orchidoideae because of similarities in column and lip structure. (They included nearly all orchids in Orchidoideae.) In 1974, Dressler transferred Rhizanthellinae to Gastrodieae, subfamily Epidendroideae, because of Lavarack's work on Australian Neottioideae showed them to be related.

In his treatment of Australian indigenous orchids, Dockrill (1969) followed Vermeulen (1966) in placing Rhizanthellinae in Neottieae, subfamily Epidendroideae. (Vermeulen placed nearly all orchids in Epidendroideae.) Because of misunderstandings dealing with column structure, this subtribe has been transferred not only within tribes, but also within different subfamilies.

Since 1928, *Rhizanthella* has remained monotypic and has been collected only eight times. Nicholls (1969) reported that it was close to *Cryptanthemis slateri* Rupp, another underground orchid which differs in the length and adnation of perianth parts and long lateral appendages on each side of the anther. Since I have only seen literature pertaining to this taxon, I cannot say with certainty if it is indeed a distinct genus, but judging from the drawings and descriptions, I would say that it is another species of *Rhizanthella*.

DISCUSSION

Two floral specimens of *Rhizanthella gardneri*, eight specimens of *Cephalanthera*, three specimens of *Limodorum*, two specimens of *Epipactis*, and one specimen of *Aphyllorchis* were examined. The flowers of *Rhizanthella* were found to resemble in great detail those of several species of *Cephalanthera*, especially *C. grandiflora* (L.) Babing., which Darwin (1877:81) illustrated in his book on the fertilization of orchids. The column structure

(Figures 1, 11) also resembles *C. austinae* (A. Gray) Heller (Figures 8, 12), *C. pallens* L. C. Richard (Figure 7) and *C. rubra* (L.) L. C. Richard. The only noticeable distinction in the column structure is the free anther filament (Figures 7, 12) present in some species of *Cephalanthera*.

Of the 15 species of *Cephalanthera*, a few spend most of their life in the ground waiting for optimal conditions in order to flower above ground. Most species also live in a mycorrhizal association. In all but one species, the flowering stem has green leaves. *Cephalanthera austinae*, closest in habit to *Rhizanthella*, is totally saprophytic, white, and leafless (Luer, 1975).

Because of the above facts, *Cephalanthera* and *Rhizanthella* are considered here to be related. *Cephalanthera* shares several important characteristics with *Rhizanthella*. Both have large floral bracts, subterranean rhizomes, and resupinate flowers. Both have a dorsal sepal which is adnate to the lateral petals forming a hood over the column. The labellum protrudes from the center of the flower. Both apparently lack a viscidium and rostellum and the endothelial thickenings (Figures 2, 9) are circular, the stylar canal entrance is in the lower center of the stigmatic lobes. The inflorescence of *Rhizanthella* is distinct in forming a capitulum and the labellum is clawed. The pollinarium is similar to other Limodorinae consisting of monads (Figure 10) in *Cephalanthera* and tetrads (Figures 4, 5, 6) in *Rhizanthella*. The exine is foveolate to reticulate depending on orientation in the pollinium (Figures 3, 4, 5, 6, 10) in both genera. The situation of both monads and tetrads occurring in the same subtribe is not uncommon. It is also found in Diuridinae, subfamily Orchidoideae.

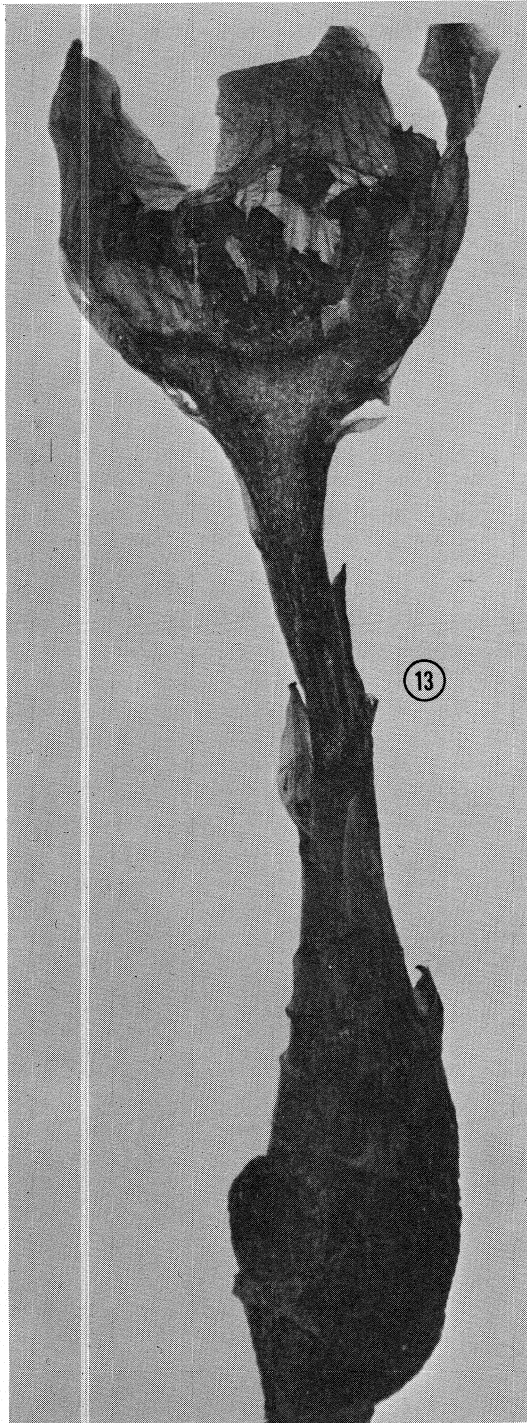


Figure 13. *Rhizanthella gardneri*, from George 15717, preserved specimen showing entire plant.

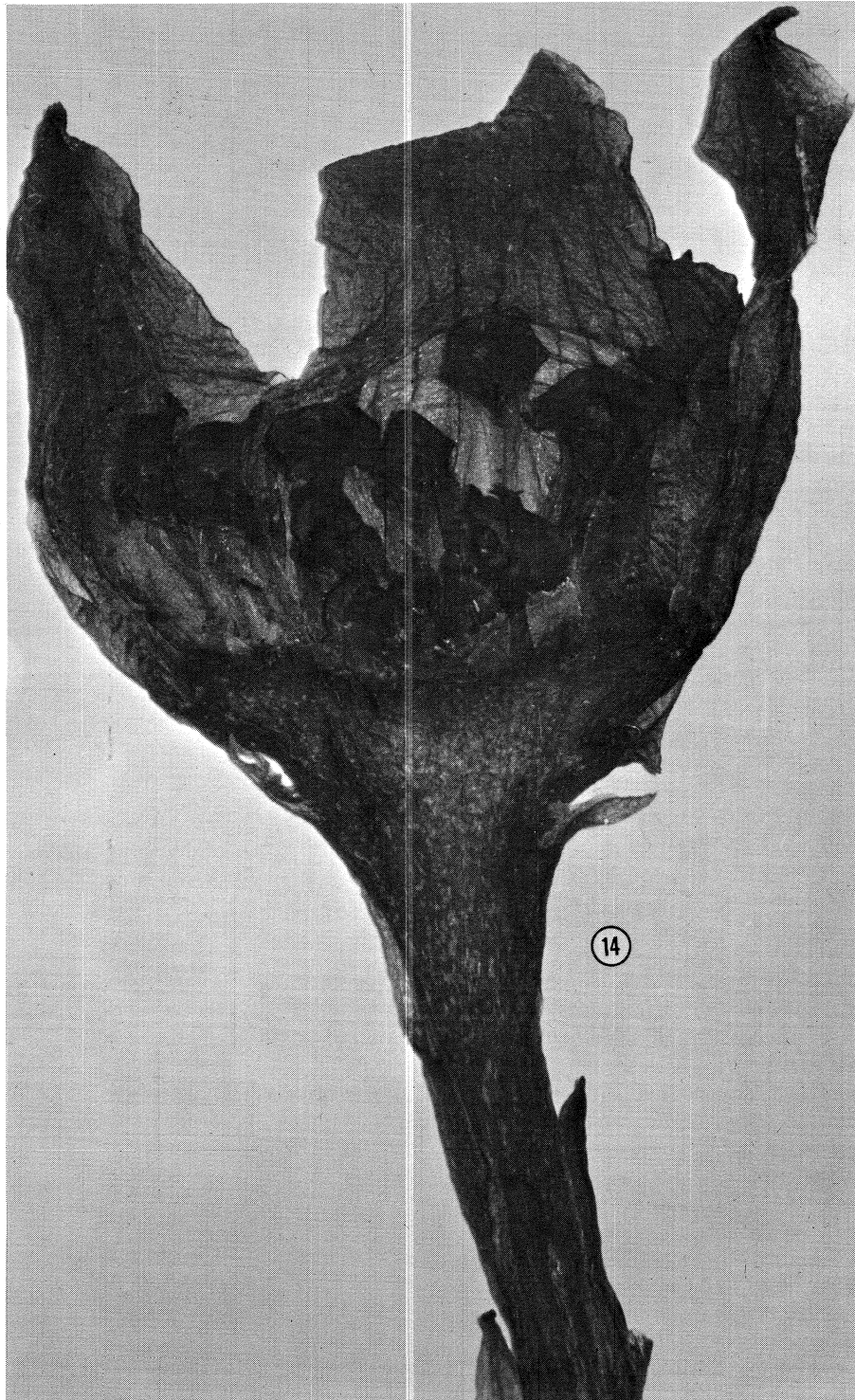


Figure 14. *Rhizanthella gardneri*, preserved inflorescence showing capitulum and large floral bracts.

The majority of cephalantheras have spreading lateral sepals, but *C. pallens*, *C. longifolia* (Huds.) Fritsch., and *C. damasonium* (Miller) Druce, the type of the genus, have lateral sepals and petals closely spaced or adherent as *Rhizanthella*.

Although *Rhizanthella* is now restricted to Western Australia and *Cephalanthera* to northwestern United States, Europe, North Africa, and Asia, *Aphyllorchis* Blume, also in Limodorinae, occurs in Australia.

Because of similar column morphologies, *Rhizanthella* is transferred to subtribe Limodorinae, tribe Neottieae, subfamily Orchidoideae (sensu Dressler, 1981).

Specimens examined: *Aphyllorchis pallida*, Borneo, *Clemens 323* (US). *Cephalanthera austinae*, Oregon, *Coombes* (US); U.S.A., *Lyon 99* (US); Washington, *Sandberg & Leiberg 571* (US). *C. grandiflora*, France, *Cintract*, 1886, (US). *C. pallens*, Scandinavia, *Oldberg*, 16 July 1867; Germany, *Dressler*, June 1885, (US). *C. rubra*, Yugoslavia, *Podpera*, 21 June 1925, (US); Germany, *Sandershausen*, July 1882, (US). *Epipactis gigantea*, California, *Heller & Kennedy 887* (US). *E. rubiginosa*, Bulgaria, *Stephanoff & Georgieff*, 8 August 1932, (US). *Limodorum abortivum*, Greece, *Franchschi 343* (US); France, *Bouleie*, July 1878, (US); France, *Drome 6 June 1895*, (US). *Rhizanthella gardneri*, Australia, *George 15717* (PERTH, US); Australia, *McGuinness s.n.* (PERTH).

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